Study on Basket Document Factory Plant Layout for Proficient Production

Wisitsree Wiyaratn and Anucha Watanapa

***Abstract*—This work focus to modify the plant layout of basket document factory to eliminate obstructions in material flow and thus obtained high productivity. The present plant layout and the operation process of each section have been investigated based on SLP method. The distance for basket document production of each plant layout has been simulated by arena program. The result showed that alternative plant layout C should be selected because decrease the distance of material flow, which improve basket document production.**

***Keywords*—plant layout, material flow, production,**

I. Introduction

Increasing competitive industries sectors, the factories have to produce the effective quality products. This action could be conducted under existing resources such as employees, machines and other facilities. However, plant layout improvement, could be one of the tools to response to increasing industrial productivities. Plant layout design has become a fundamental basis of today's industrial plants which can influence parts of work efficiency. It is needed to appropriately plan and position employees, materials, machines, equipments, and other manufacturing supports and facilities to create the most effective plant layout. The plant layout and with that the material flow have shortages in almost all manufacturing companies. The changing of product volume, machine, process for production and material handle equipment is observed. Plant layout design deals with the modified plant layout to increase the high production based on effective arrangement with differing space requirements. There are many researches used systematic layout planting (SLP) method to design plant layout. For example the overall layout of log yards, the result showed the good workflow. Plant layout analysis and design for multi-products line production has been studied by Jaturachat *et al*. [1] .This work was carried out to investigate the suitable plant layout design for denture manufacturing. The suitable 4 plant layout models were designed and compared the efficiency of each plant by adjacency-based scoring. Moreover, line balancing was done to allocate human resource by using simulation programming (Arena 10) to find the increasing productivity of the new improvement layout. These thus reflect the importance of the plant layout design to bring about an increase in productivities [2]. Another research simulates the factory layout using the software ARENA (student's version). Operation section of each machine is calculated. The efficiency of production depends on methods ,machines, facilities and employee's amenities in a plant. [3]

Nowadays many advanced algorithmic approaches have been used for solving the plant layout design e.g. a dynamic programming approach, Rosenblatt (1986); genetic algorithm technique, Lee et al. (2003), El-Baz (2004); the ant colony optimization algorithm Bacykasogle et al. (2006) etc [4] . Aju Pius Thottungal and Sijo.M.T showed that work is done in a forging industry where is located in southern India. It presents that the best alternative layout for the existing plant by using ARENA software and heuristic method ALDEP (automated layout design program). For a continuous production best form of layout is the product layout. Firstly, the utilization of the machineries in the present plant layout is analyzed by ARENA software. After that the best alternative layout is calculated with the ALDEP. Finally, the utilization of the machineries in the alternative layout is computed by simulating the plant layout again using the ARENA [5].

In this research, we focused on PE coating factory for basket document production. According to study, the product of this factory is basket document, basket cage for motorcycles and motorcycle parts. PE coating factory have a desire to improve production lines basket document plant layout as required SLP method and Arena in the simulation and the data processing steps and cost of production. To meet the need to reduce costs and increase the productivity of PE coating restricted to greater productivity and lower production costs. This work is based on the analysis of existing layout. The arrangement of machines is simulated using the software and efficiency of each machine is analyzed. The software ARENA is used for plant layout modeling. The queuing, productivity rate of process have been reported.

II. Plant Layout Planning

A. The principles of SLP

SLP is a method of plant layout design of project, which described step -by -step of method. The information of P, Q, R, S, T, is product, quantity, route, support and production timing as the given basic elements. Many of tables, graphs, as analytical tools, carry out the design through the layout methods. The procedure of SLP is shown in Fig. 1 [6]. The SLP procedure can be used to develop a block layout and then a detailed layout for each planning. The SLP method shows the relationship between the analysis of operation

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units, and requirement of area. The space areas requirement was determined. Then the location of the operating units was drawn and the alternative plant layouts were designed. At last, the preferred plant layout was selected in term of the increasing production and minimal cost adjustment. However, plant layout must include not only the needs for the present demand of production but should also have design for future development or expansion.

B. *Procedure for Plant Layout Designs*

The sequences of procedure following three steps were described

1. Information from PE coating was collected.

1.1 The data were collected and size and number of machines/ equipments for manufacturing was counted in terms of the direction for raw materials and product

1.2 The process for product production has been used in analysis.

1.3 The area of operation units such as machines/equipments was measured and space limitation of product layout has been studied.

1.4 The present plant layout was analyzed to identify the problem under flow material and operation.

2. Analytical data problem and improve process layout

2.1 The problem has been defined.

2.2 SLP has been used to improve present plant layout

3. Assessment and summary

3.1 Evaluated by comparing the present plant and plant layout to improve with SLP and Arena

3.2 The suggestions were collected to write the report and were proposed to authorize to make decision for rearrangement the plant layout.

C. *Simulation using Arena Program*

The current layout of the basket document factory is studied and analyzed. The current layout and alternative plant layout of the industry is created in ARENA program version 14 and distance evaluation of basket document production is calculated.

III. Analysis Plant Layout

A. *Analysis of present plant layout*

This case is based on a PE coating factory, where located in Thailand. The basket products are made to order under customers and upon completion will be sent to the customer immediately. The PE coating factory required reducing distance transport of raw materials and increasing productivity. The plant layout of basket document production has limited spaces. The plating department and warehouse supplies products have been used together with other production lines. Therefore possible to improve the area used in assembly and preparation of raw materials basket only documents. This area consisted of 4 wire cutting machines , 7 Spot Wielding machines, 3 wire bending machines, 1 air pump machine, 1 table per edge, 1 collection work point section, 2medal pumps. From the collection of information it can be concluded that the production layout is prepared to process layout by activity relationship , regardless of the production line can be improved. The size of the equipment was relational to the area as shown in Table 1.

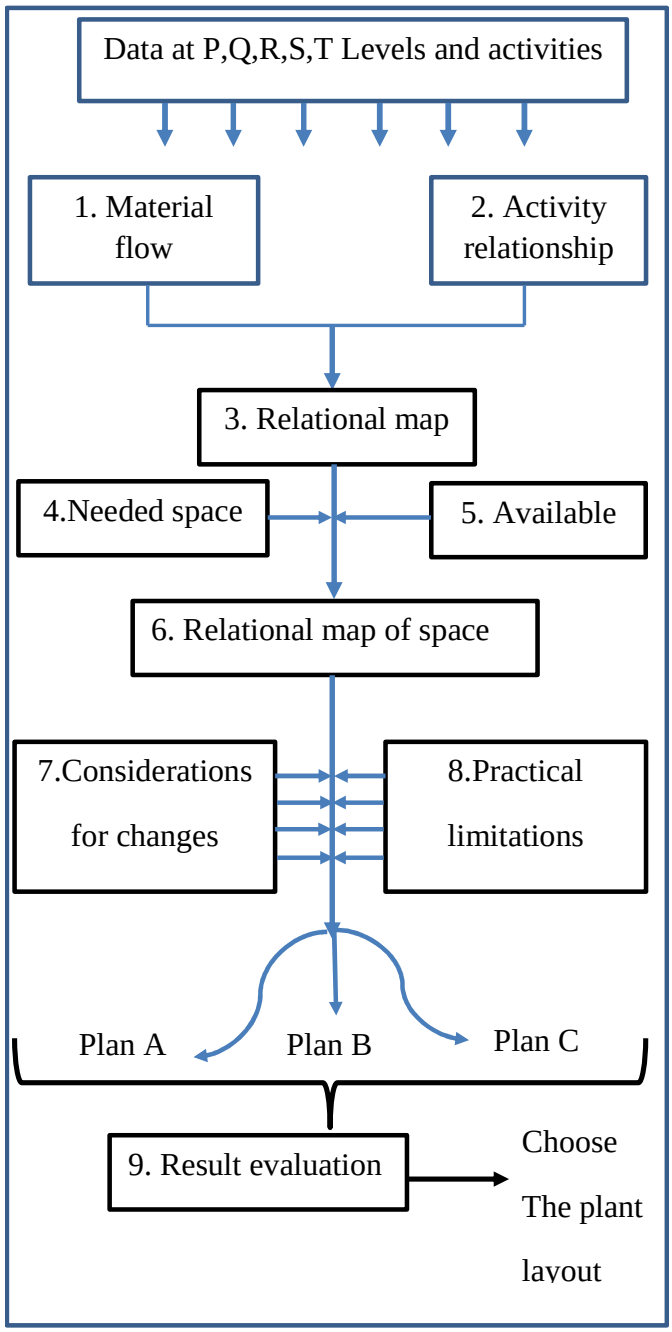

Fig. 1. The procdure of SLP [6]

According to the study of the manufacturing process, it was found that the long distance could be reduced for moving raw materials and the problem about useless area could be solved. The way to improve the plant was to apply SLP method to make the work flow continually by arranging the important sequence of the manufacturing. The initially, from to chart was studied, which showed the relationships between departments in each process. The entries in the chart represented the number of material between departments in each process of each day. Then the relationship of each activity in closeness area was considered to make the relationship of each activity, and the closeness value are defined as A =absolutely, E = especially important, I = important, O= ordinary closeness, U= unimportant. The details for each activity were described in

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Table 2, as follow.

TABLE I
THE WORKFLOW OF THE MANUFACTURING PROCESS

Department	Total working area (m^2)	Number of equipments and machines	Working area per unit
Wire cutting machine	31.2	4	7.8
Wire blending machine	14.4	3	4.8
Spot welding 25 kVA	12	3	4
Pump machine	8	1	8
Spot welding 50 kVA	8	2	4
Store	7.6	1	7.6
Edge the basket	4.4	1	4.4
Medal pump	8	2	4
total	93.6	17	44.6

TABLE II
THE WORKFLOW OF THE MANUFACTURING PROCESS

A. Wire cutting
B. Wire blending machine
C. Spoting welding 25 kVA
D. Pump machine
E. Spoting welding 50 kVA
F. Store
G. Edge the basket
H. Medal pump
I. Plating department

Product	(Per day)	Routing
Basket	15	A-B-C-D-E-F-G-H-I

The important sequence of each activity was rearranged from the most important one to the least important one as shown in Fig 4

Fig. 2 Alternative plant layout

Based on SLP method the modifying plant layout and practical limitations, a number of layouts were developed. The alternative plant layout displayed in Fig 2, Fig 3. Alternative plant layout represents A, B, C. In case of present plant layout, the transport distance for basket document production of 92 meters and an Arena simulation shows the waiting area at the spot wielding 50KVA which the waiting queue average is 9.4158 and an average production rate of 148.8 parts per hour. Plant layout basket documents of A , distance transport is 66.4 meters , which is less than the distance of transportation of a present plant layout 27.8 % , or 25.6 m. and simulated on arena program will be waiting at the spot wielding 50KVA average is 8.6509 , which is less than the present production layout basket document 8.1235 or 0.8108 % waiting queue and the average production rate of 149.2 parts per hour. Plant layout basket document of B with distance transport 72 m, which is less than the distance of transportation of a present plant layout 22.8 percent, or 21 m. and simulated on arena program will be waiting at the spot wielding 50KVA average is 8.9393, which is less than the present plant layout basket production 5.0606 or 0.4765 % waiting queue and the average production rate of 149 pieces /hour. Plant layout

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basket document C a distance of 73.9 m , which is less than the transport distance transport of the present plant layout 18.1 m. and 19.7 % of applications simulated on arena program will be waiting at the spot wielding 50KVA Average is 8.4748 , which is less than the present plant layout basket document 9.9938 , or 0.941 % of the waiting queue and the average production rate of 149.7 parts per hour.

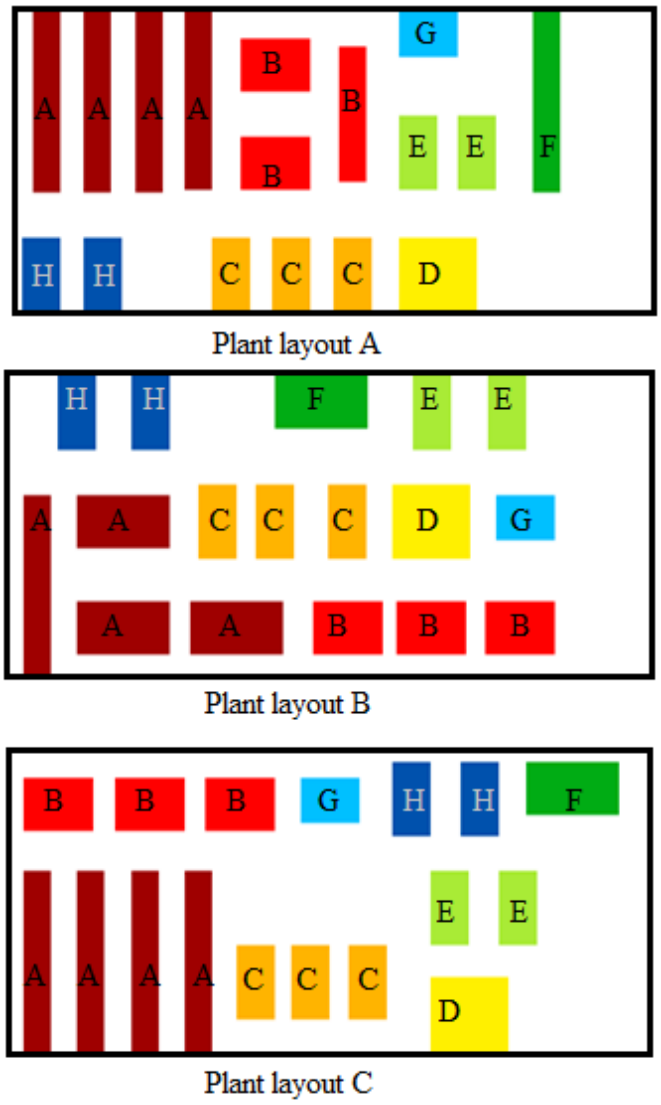

Fig. 3. Alternative plant layout of basket document production

IV. Conclusion

According to the analysis of the arena simulation, it was found that plant layout basket document C is better than plant layout A, B. The distance can be reduced 18.1 m. However it has to queuing at spot wielding 50KVA average is 8.4748, which is the minimum than others. It showed the maximum flow rate for produce an average of 149.7 parts per hour. It can be concluded that plant layout basket document c should be concerned. Finally, rearranging layout decreased distance and time consumption in flow of material and accidents, resulting in an increase in productivity.

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